San Joaquin River Selenium TMDL

Regional Board Staff Workshop

16 May 2001

Matt McCarthy

Les Grober

Workshop Agenda

- Welcome and Introductions
- Overview of Regional Board's TMDL Development Process and Timelines
- San Joaquin River Selenium TMDL

Overview of Regional Board's TMDL Development Process and Timelines

What Is a TMDL and Why Do One?

- TMDL = Total Maximum Daily Load
- TMDLs are required under section 303(d) of the Federal Clean Water Act
  - TMDLs must be developed for pollutants and waterbodies that have been identified on 303(d) list of impaired waterbodies

What Is a TMDL?

- A total maximum daily load (TMDL) is the amount of a specific pollutant that a waterbody can receive and still maintain a water quality standard
- TMDLs allocate pollutant loads to point and nonpoint sources…

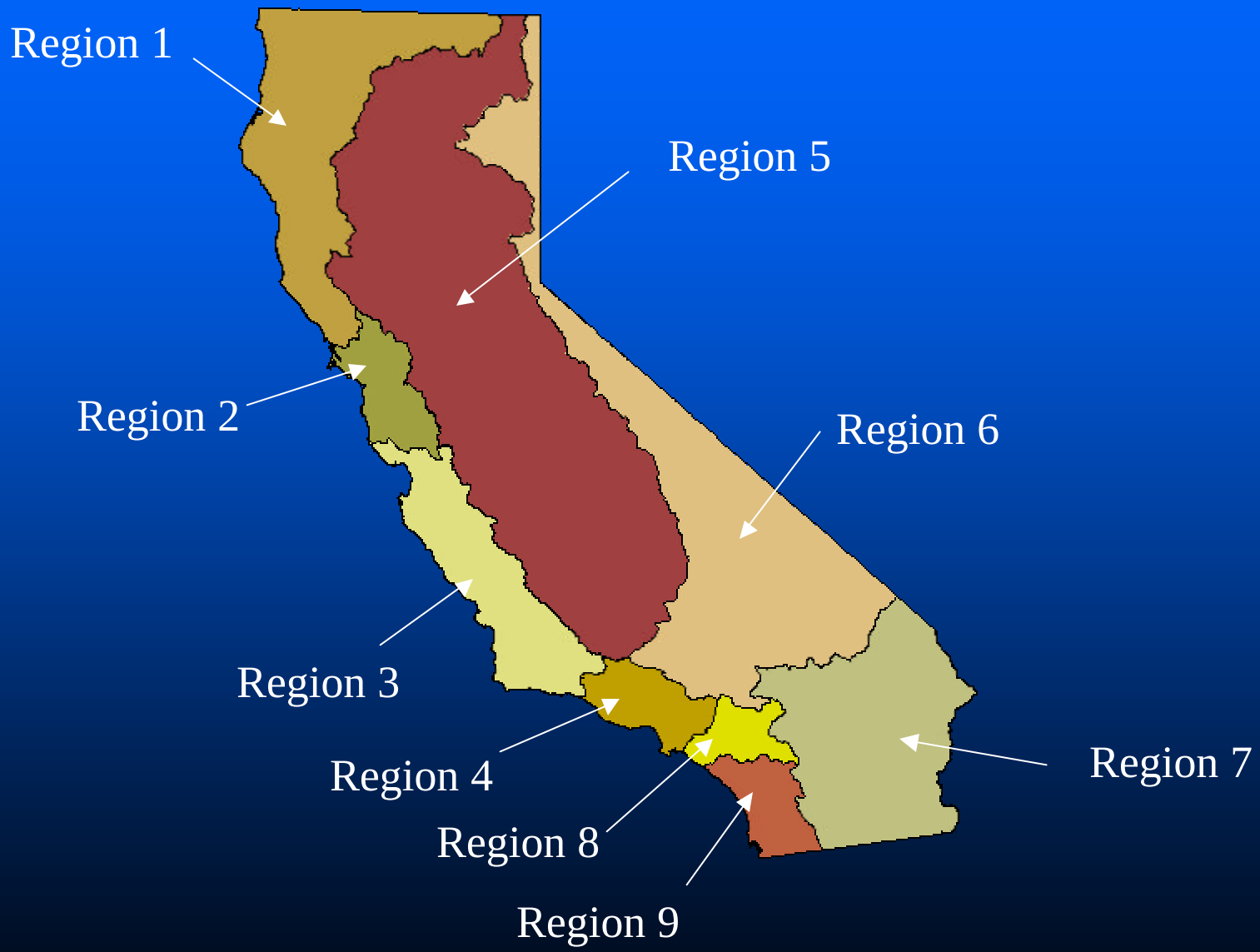
What Is a TMDL?

- TMDL = WLA + LA + MOS + background

WLA: waste load allocation for point sources
LA: load allocations for nonpoint sources
MOS: margin of safety

Components of TMDLs

- TMDL Description (Problem Statement)
- Numeric Targets (will often be new water quality objectives)
- Source Analysis
- Allocations
- Linkage Analysis (relationship between sources, allocations, and targets)
- TMDL Report
- *Implementation Plan*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Region 3
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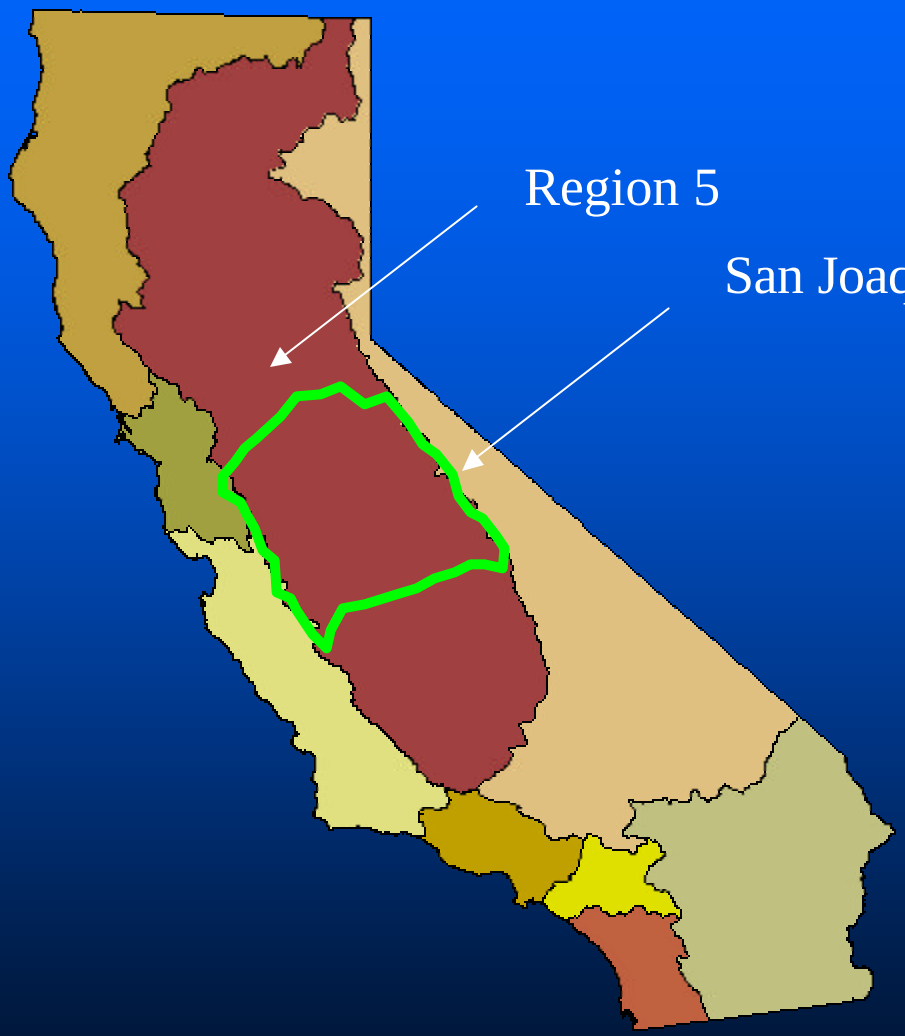
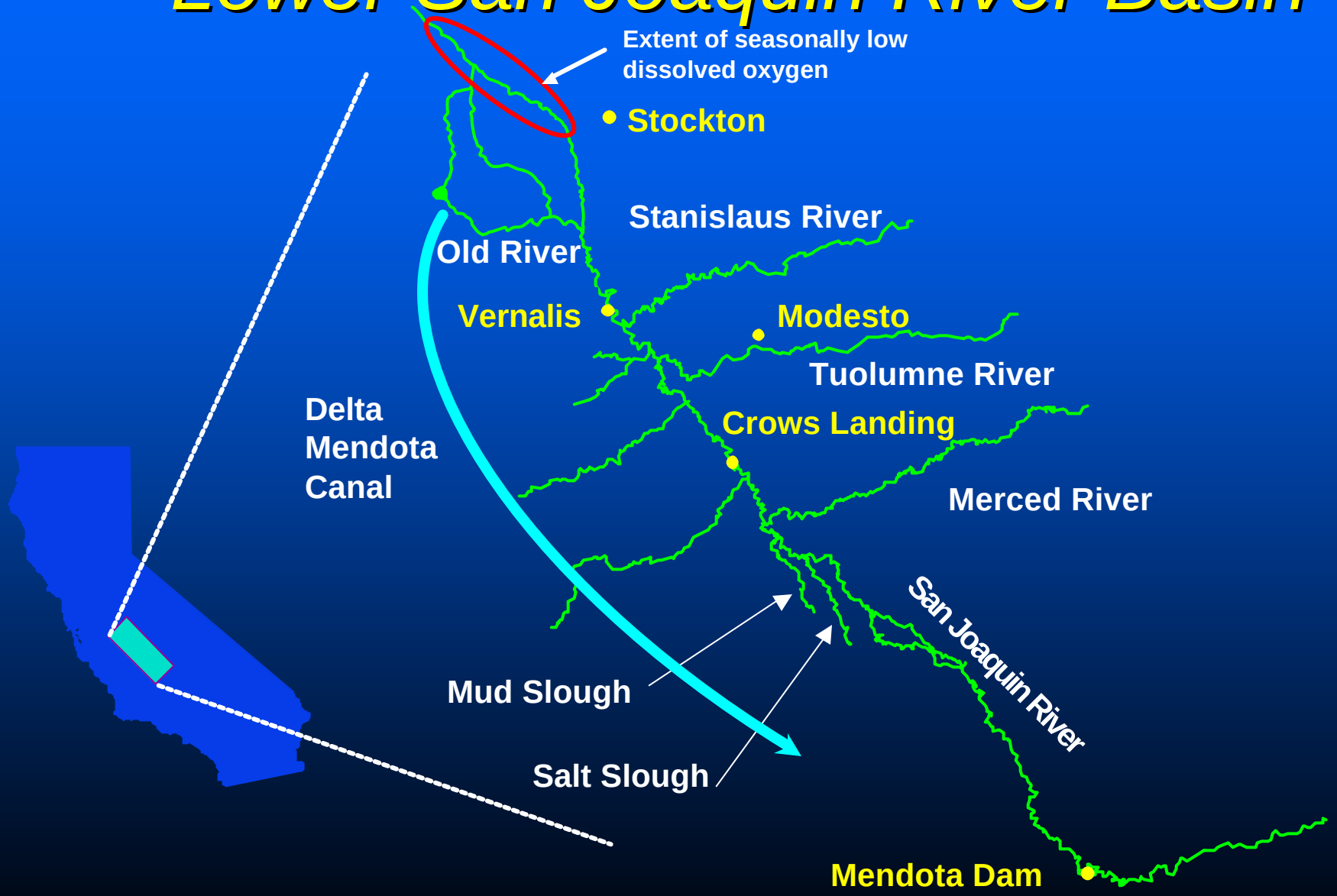
Region 7
Region 8
Region 9


Region 5
San Joaquin River Basin

Lower San Joaquin River Basin



TMDL Timeline

Current Activities

Watershed	June 2001	June 2002	June 2003
San Joaquin River	Selenium Salt & boron	Diazinon & chlorpyrifos	
Delta			Dissolved oxygen Diazinon & chlorpyrifos Mercury
Sacramento River	Copper, zinc, & cadmium	Diazinon	
Clear Lake	Mercury		
Cache Creek		Mercury	

San Joaquin River Selenium TMDL

Components of TMDL

TMDL Description

Numeric Target

Source Analysis

Load Allocation

Linkage Analysis

TMDL Report

Implementation Plan

TMDL Description

Project Area

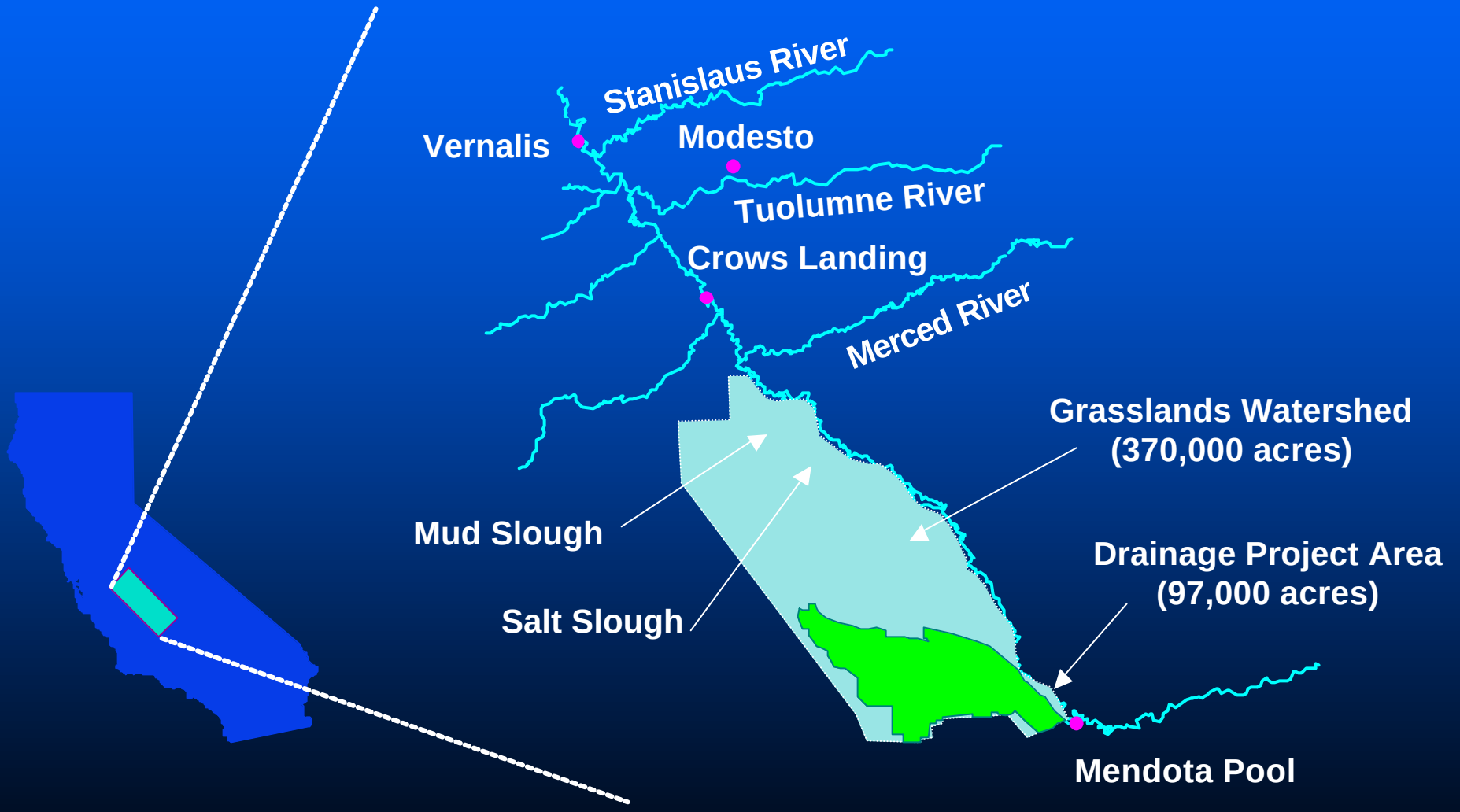
Magnitude of the Impairment

Background and History

Beneficial Uses

Reasons for Listing

Project Area for Selenium TMDL



Westland Water District

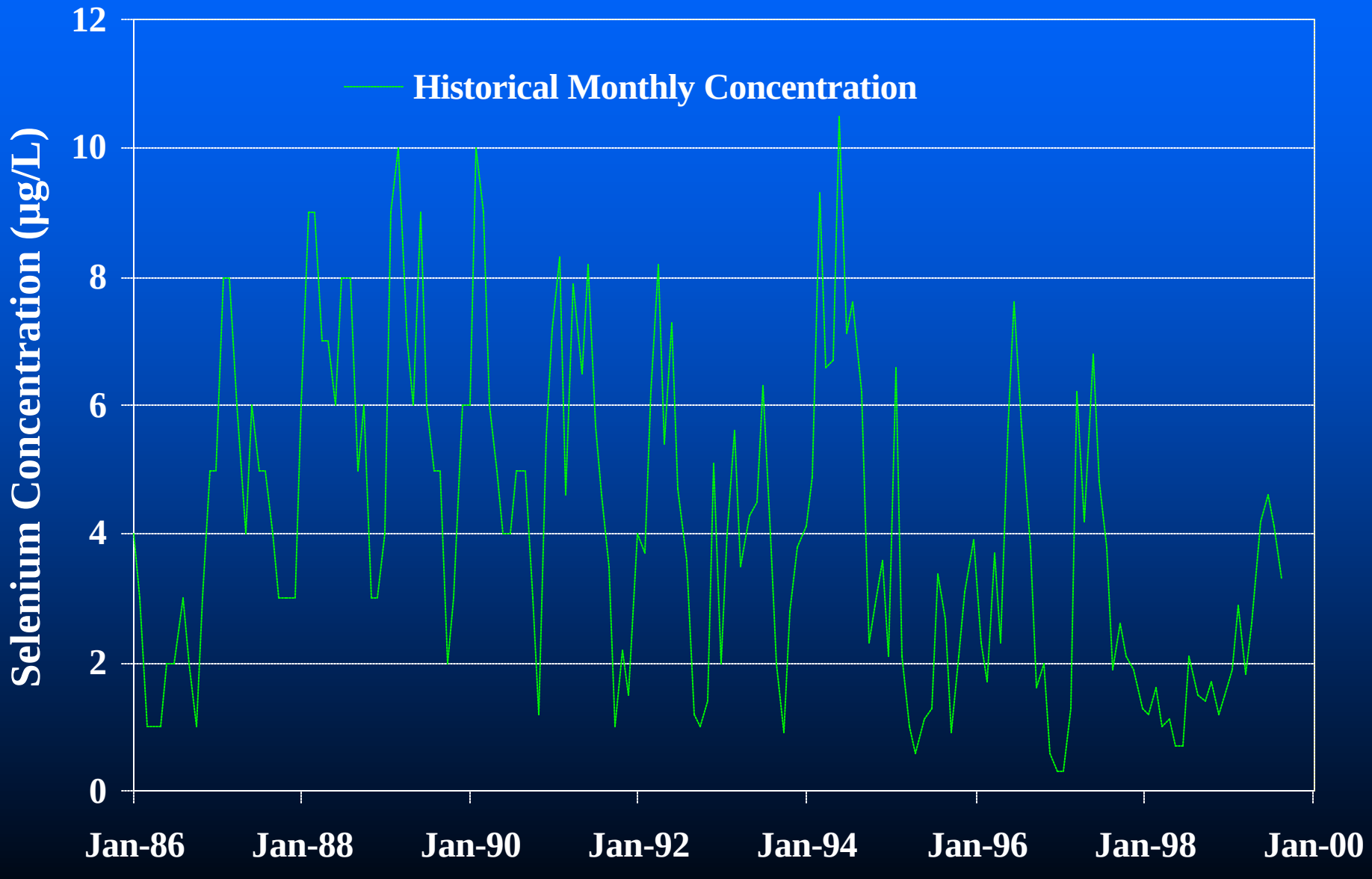
Magnitude of the Impairment

Total = 330 miles

Impaired = 50 miles from Salt Slough to Vernalis

Westland Water District

San Joaquin River near Crows Landing - 1986 to 1999



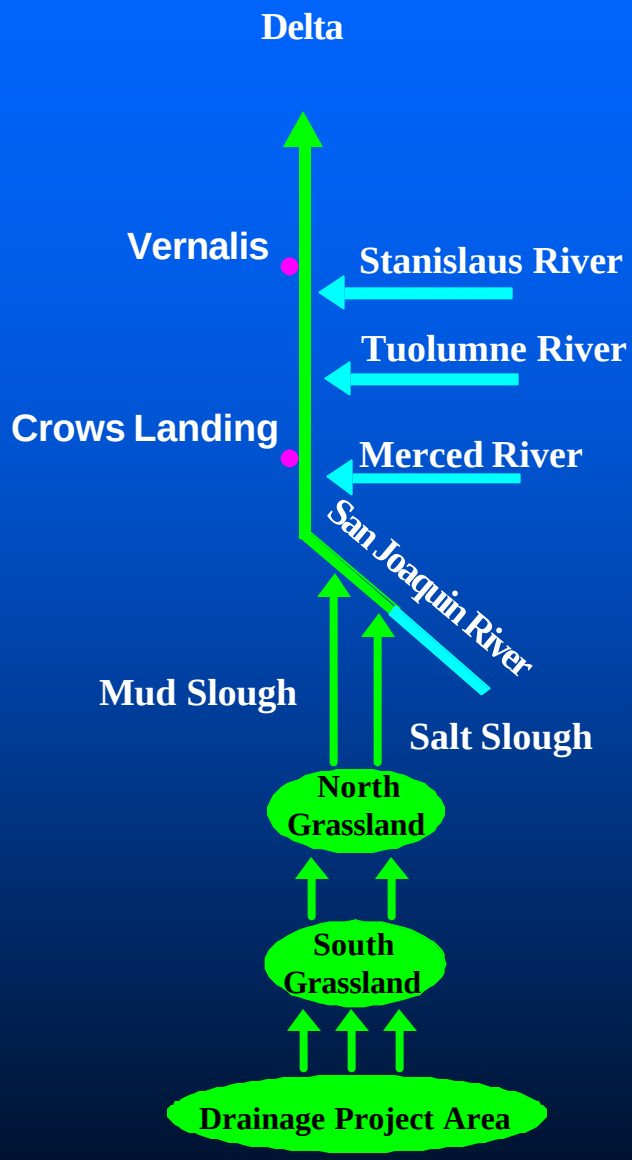
Background and History

- Construction of San Luis Drain to convey agricultural subsurface drainage from Westland Water District
- Drain construction stopped at Kesterson
  - Tile drainage used as wetland water supply
- Avian deformities found in 1983
  - Selenium found to be the cause
- Westland Water District discharge to San Luis Drain stopped

Background and History

- New scrutiny on agricultural subsurface drainage and selenium
- Grasslands Watershed, just north of Westland Water District, naturally high in selenium
- Drainage Project Area (DPA) in Grassland Watershed historically discharged agricultural subsurface drainage with high selenium concentrations to wetland supply channels
- “Flip-flop” system initiated to reduce selenium loading from 1985 to 1996

Lower San Joaquin River



Background and History

- "Flip-flop system"
  - Agricultural drainage and freshwater supplies are alternately conveyed by wetland supply channels
  - Agricultural subsurface drainage alternately discharged to Mud Slough or Salt Slough

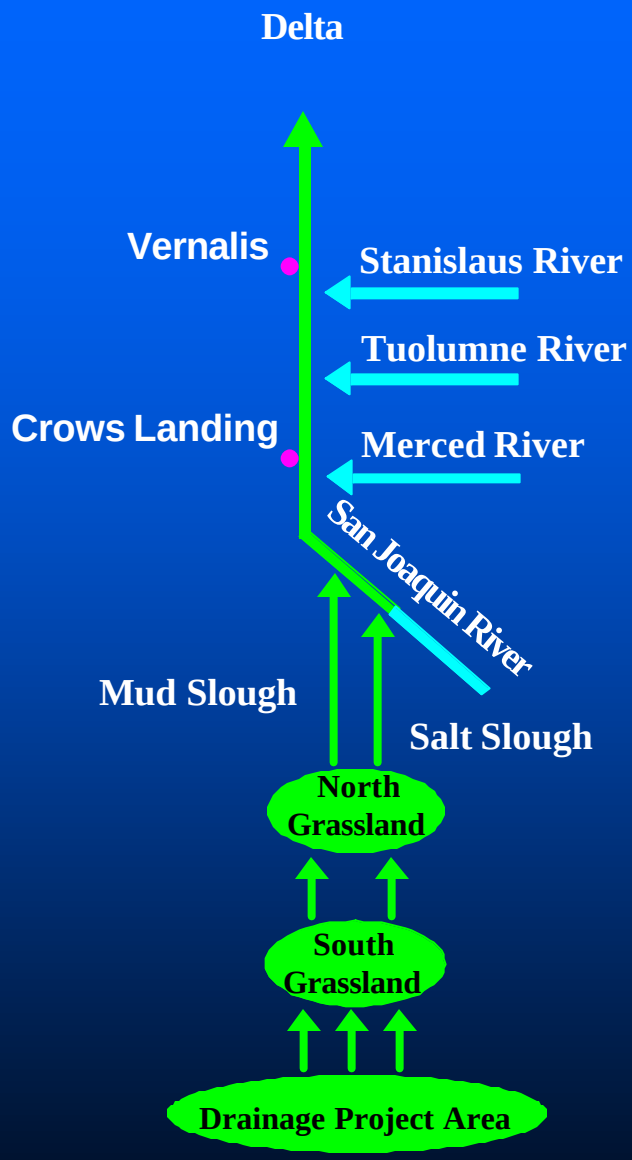
Background and History

- Grassland Bypass Project implemented in 1996
- Diverts drainage away from wetlands using portion of San Luis Drain
- Basin Plan Amendment for the Control of Agricultural Subsurface Drainage in 1996
- Waste Discharge Requirements for Grassland Bypass Project in 1998
- TMDL development

Lower San Joaquin River Pre-Bypass Conditions

Impaired
88 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired

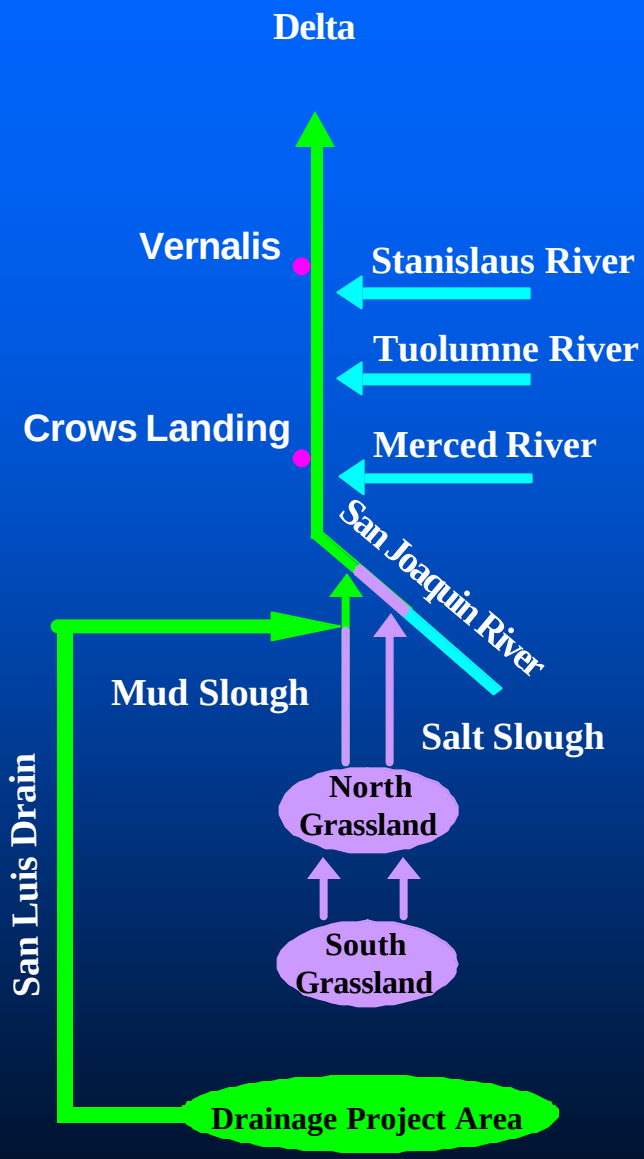


Lower San Joaquin River Current Conditions With Grassland Bypass

Impaired
57 miles natural channels

Improved
31 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired



Beneficial Uses

- Beneficial uses outlined for the lower San Joaquin River in the Regional Board Water Quality Control Plan:
  - Agriculture
  - Industry
  - Recreation
  - Warm/Cold Freshwater Habitat
  - Migration of Aquatic Organisms
  - Spawning of Fish
  - Wildlife Habitat

Beneficial Uses

- Beneficial uses outlined for the lower San Joaquin River in the Regional Board Water Quality Control Plan:
  - Agriculture
  - Industry
  - Recreation
  - Warm/Cold Freshwater Habitat
  - Migration of Aquatic Organisms
  - Spawning of Fish
  - Wildlife Habitat

Reasons for Listing

- SJR important for wildlife habitat
- Selenium found to be toxic to waterfowl
- Water routinely exceeds USEPA criteria and Regional Board Water Quality Objectives for selenium

Components of TMDL

TMDL Description

Numeric Target

Source Analysis

Load Allocation

Linkage Analysis

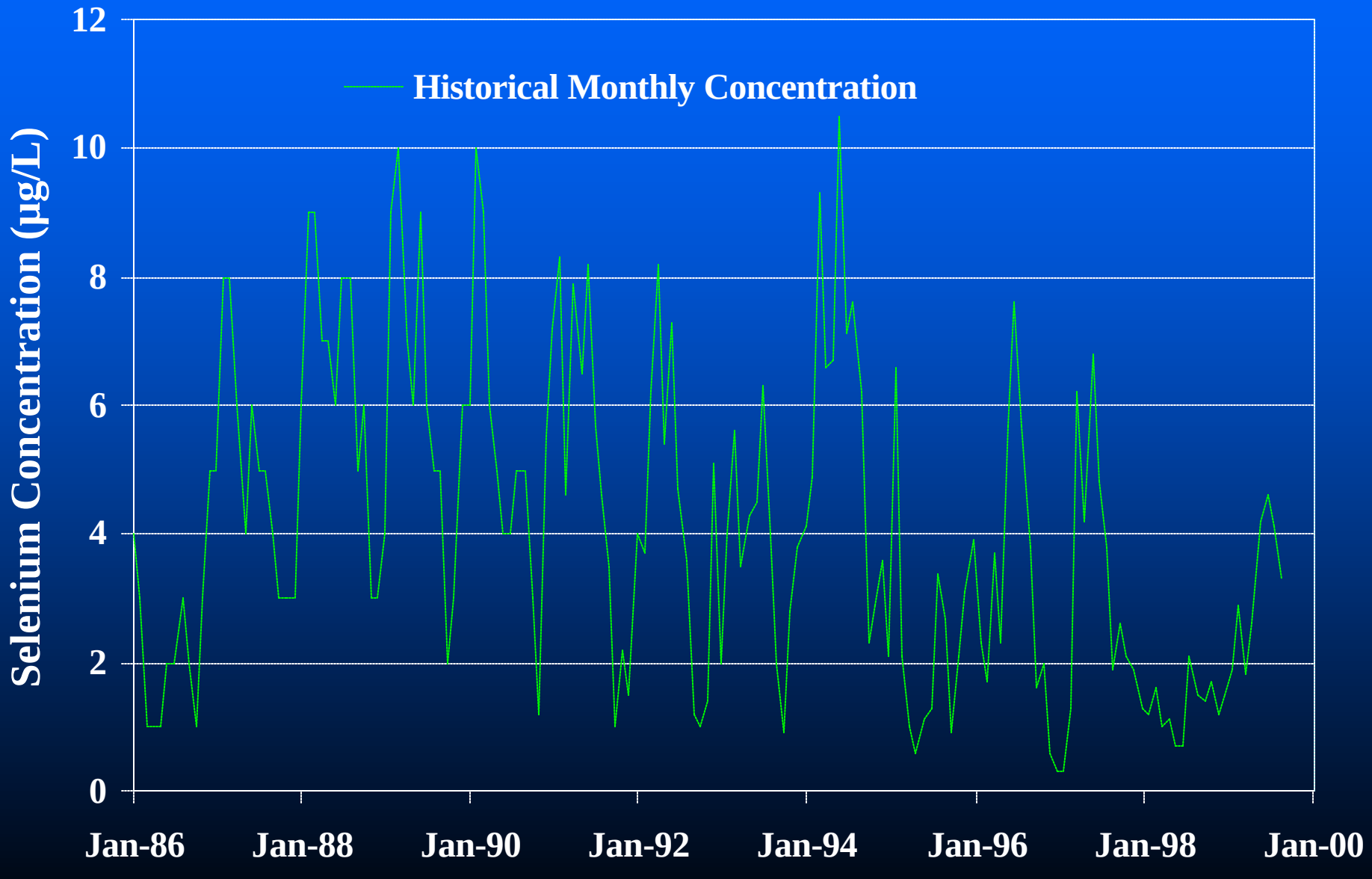
TMDL Report

Implementation Plan

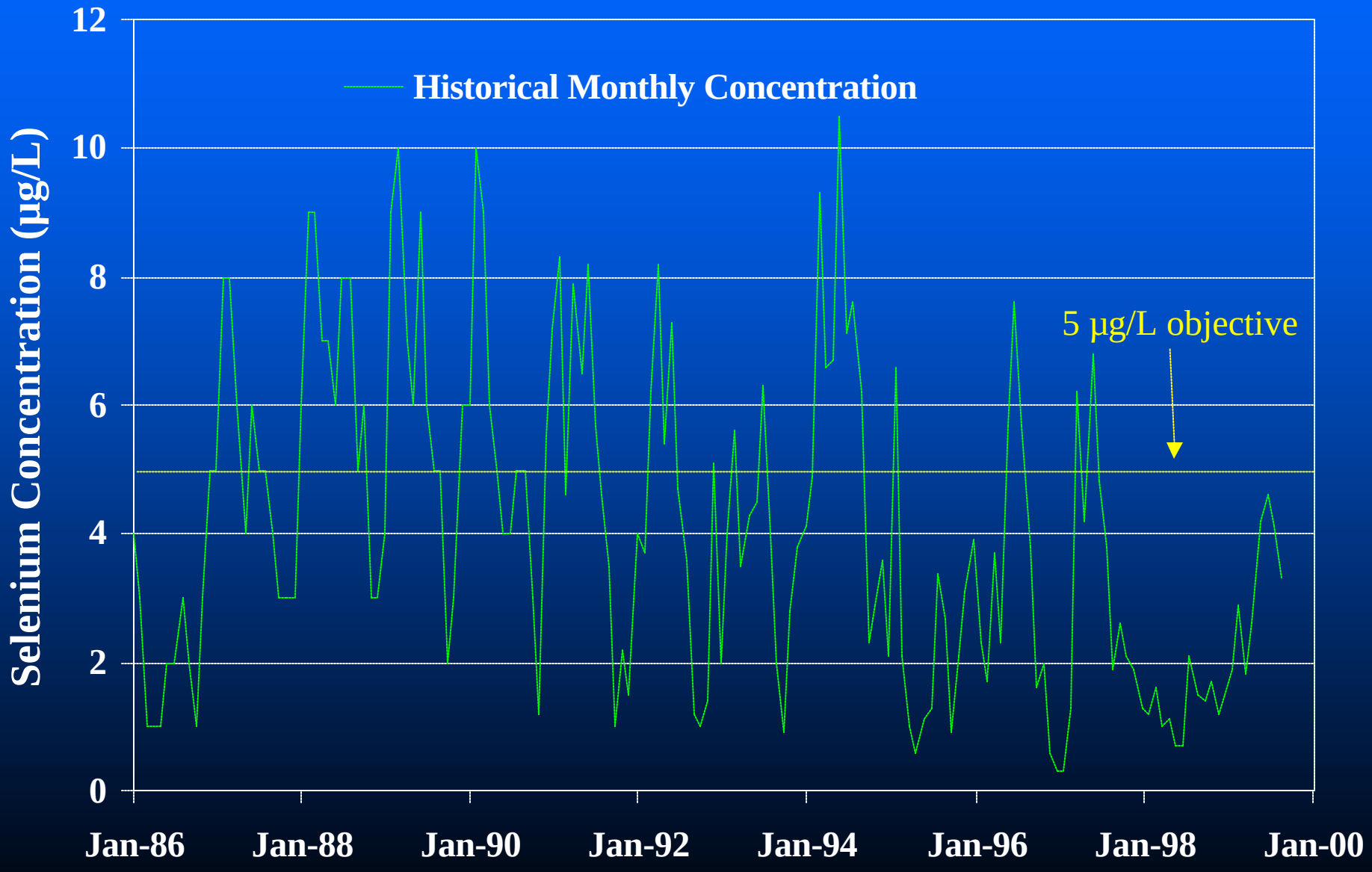
Numeric Target

- Use USEPA aquatic life criteria
- 5 µg/L 4-day average
- Water Quality Objective already in place from 1996 Basin Plan Amendment
- Approved by State Water Resources Control Board and Office of Administrative Law

San Joaquin River near Crows Landing - 1986 to 1999



San Joaquin River near Crows Landing - 1986 to 1999



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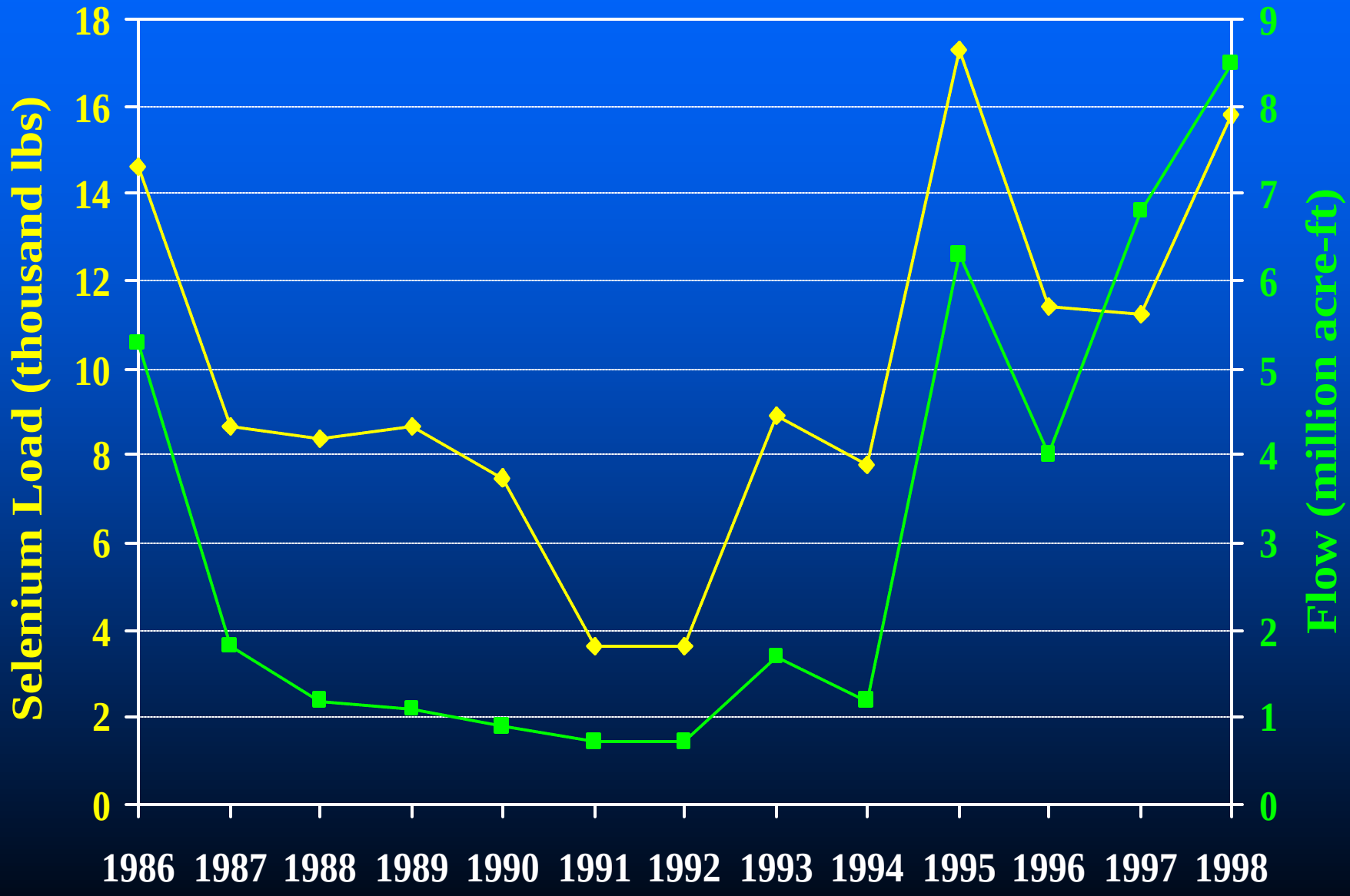
San Joaquin River near Vernalis - 1986 to 1998



Source Analysis

Subsurface Agricultural Drainage

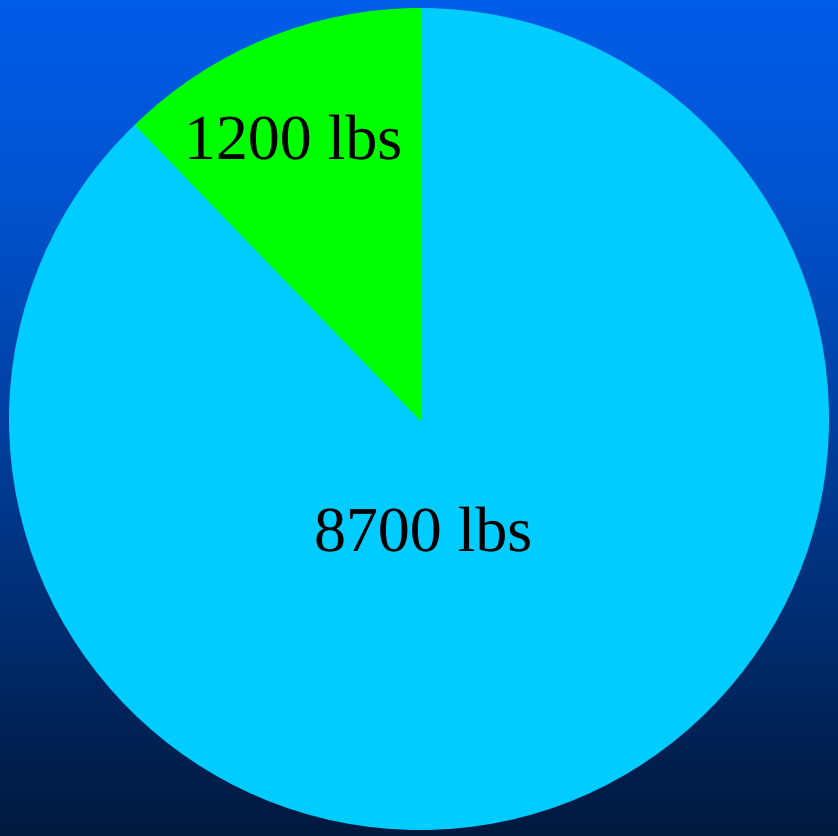
Surface Agricultural Return Flows and Wetland Discharges

Groundwater Accretions

Tributary Inflows

San Joaquin River near Vernalis - 1986 to 1998

Average Annual Selenium Loads



- **Drainage Project Area**
- **Other Sources***
  - Subsurface Agricultural Return Flows
  - Surface Agricultural Return Flows and Wetland Discharges
  - Groundwater Accretions
  - Tributary Inflows

* Other sources calculated by difference between the San Joaquin River near Vernalis and the Drainage Project Area

Components of TMDL

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Implementation Plan

Load Allocation

- Determine Assimilative Capacity
- Allocate loads among the various sources
- Use a Margin of Safety to account for uncertainties in the analyses
- Use TMML Model to calculate load allocations

TMML Model Overview

- Originally developed by Regional Board staff in 1994
- Updated with new flow data by USBR staff in 2000
- Uses historic flow data to calculate design flows
- Based on a monthly (TMML) rather than daily (TMDL) time step
- Design flows combined with WQOs to provide TMMLs

Flow Data

- Data for 1970 to 1999
- Flow record divided into four water year groups
- Further divided into four seasons
  - Based on drainage and river flow patterns
- Results in 16 flow regimes

TMML

- TMML = Design flow x WQO
- Design flow is the 4-day low flow for the flow regime that results in the allowable rate of exceedance
- One in three year exceedance of WQO

Load Allocation

Load allocation = TMML - background - margin of safety

No waste load allocation (no point sources)

Background Load

- Calculated from three major sources of flow and selenium: Merced River, San Joaquin River upstream of Grassland Watershed, Grassland wetlands
- Merced River = 0.2 µg/L
- San Joaquin River upstream of Grassland Watershed = 0.5 µg/L
- Grassland wetlands = 1.0 µg/L

Margin of Safety

- Required by Clean Water Act
- Accounts for uncertainty in the process
- Explicit ten percent margin of safety used in this TMDL

Annual Load Allocation Values

Time Period	Year Type	TMML	Background Load	Margin of Safety	Load Allocation
Oct-Sept	C	1,320	115	132	1,073
Oct-Sept	D/BN	2,963	172	296	2,495
Oct-Sept	AN	4,996	333	500	4,163
Oct-Sept	W	5,367	351	537	4,479

Components of TMDL

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Linkage Analysis

- Describes relationship between numeric target, identified sources, and allocations
- Provides assurance that load limits will result in attainment of water quality objectives

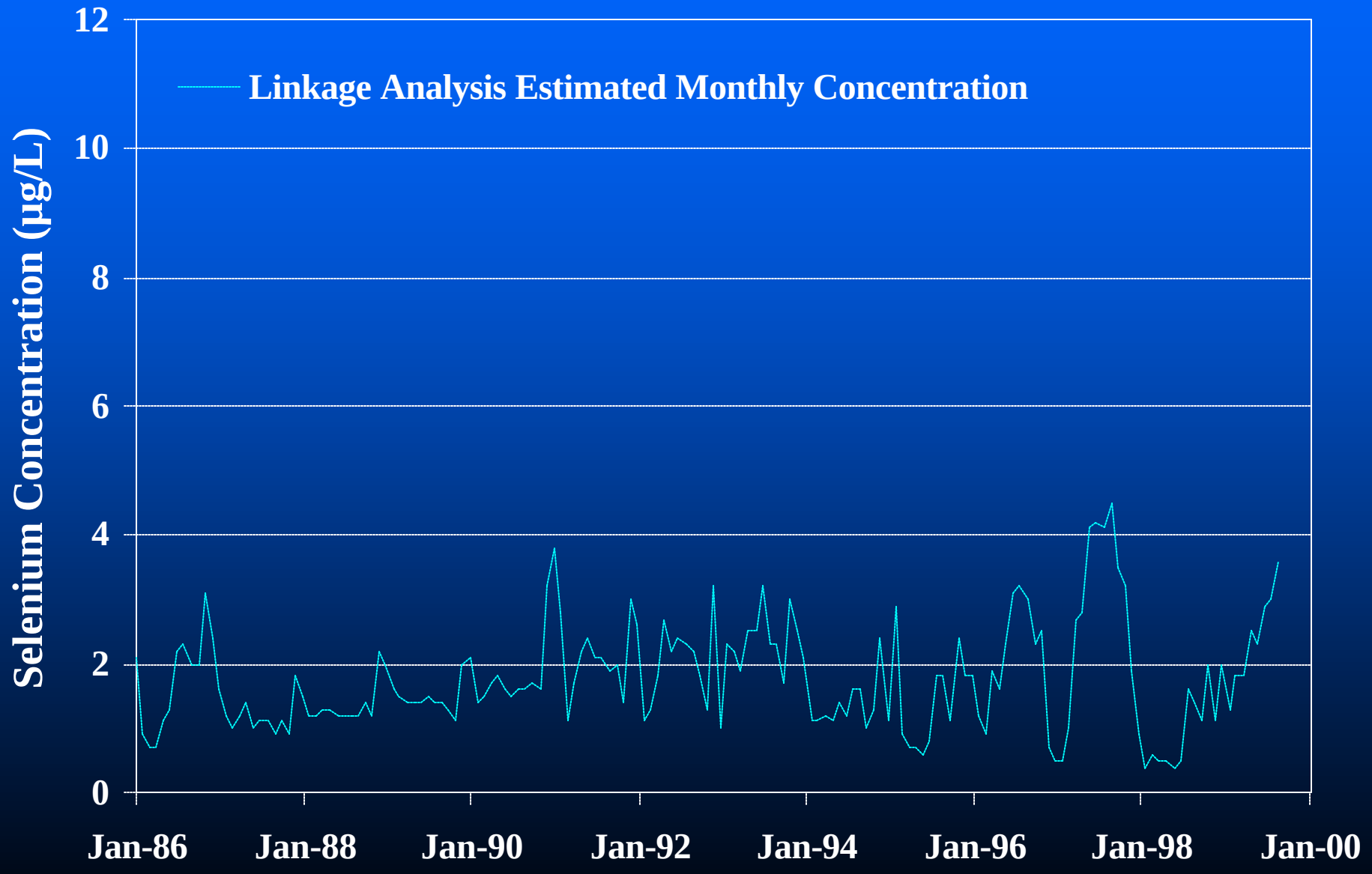
Methods

- Flow Record: WY 1986 to 1999
- Calculate background selenium loads based on historical tributary flows and estimated mean concentrations:
  - SJR upstream of Grassland Watershed
  - Merced River
  - Mud Slough and Salt Slough
- Add load allocation from GBP
- Calculate SJR selenium concentration

San Joaquin River near Crows Landing - 1986 to 1999

Year Type	Month	Load Allocation (lbs)	Tributary Loads (lbs)	SJR @ Crow's Landing		Violation?
				Flow (cfs)	Conc (µg/L)	
W	May-86	512	195	240,407	1	NO
C	Feb-91	93	16	14,360	3	NO
C	Dec-92	152	19	20,226	3	NO
W	Aug-98	366	97	108,061	2	NO

San Joaquin River near Crows Landing - 1986 to 1999



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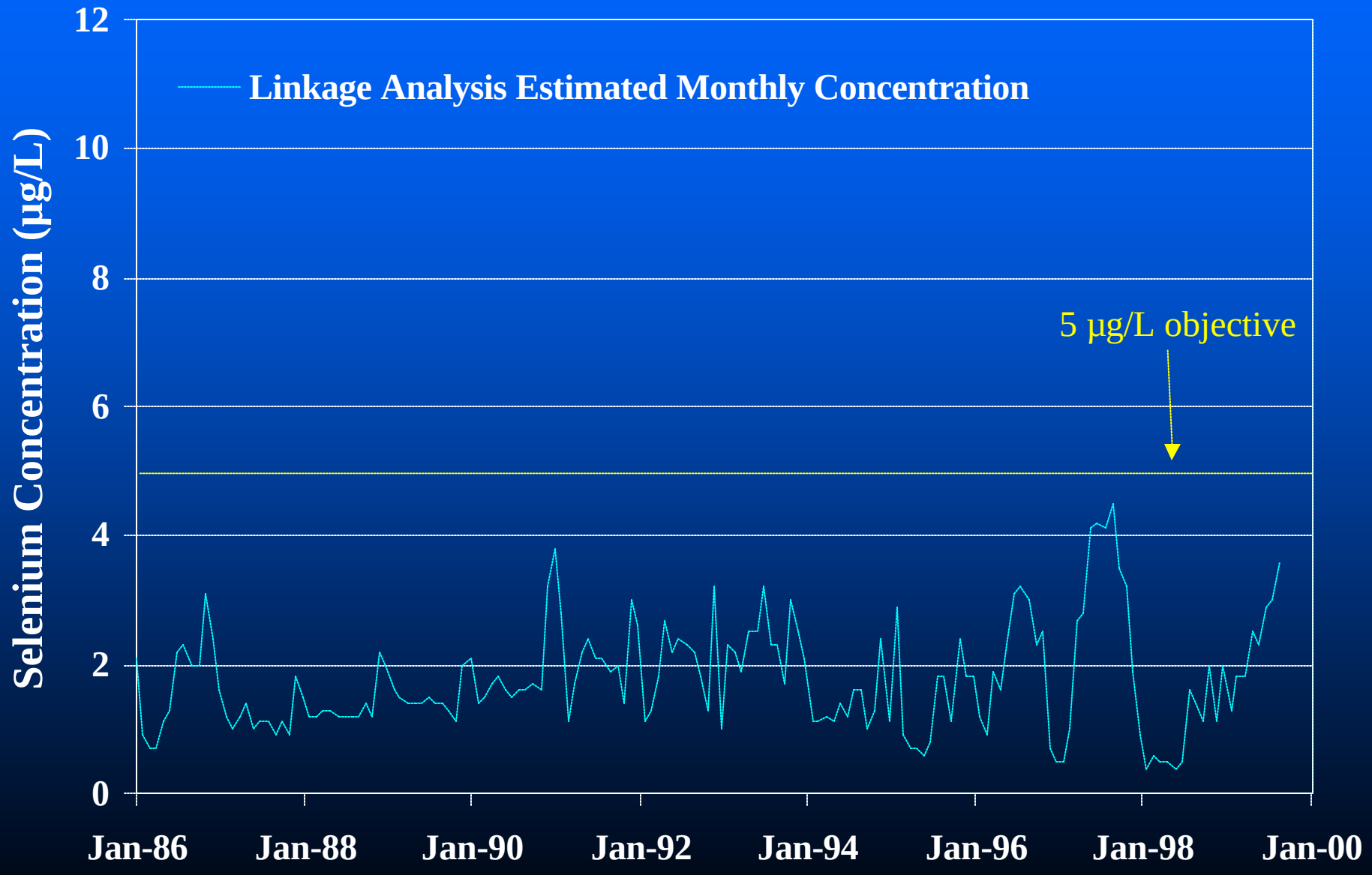

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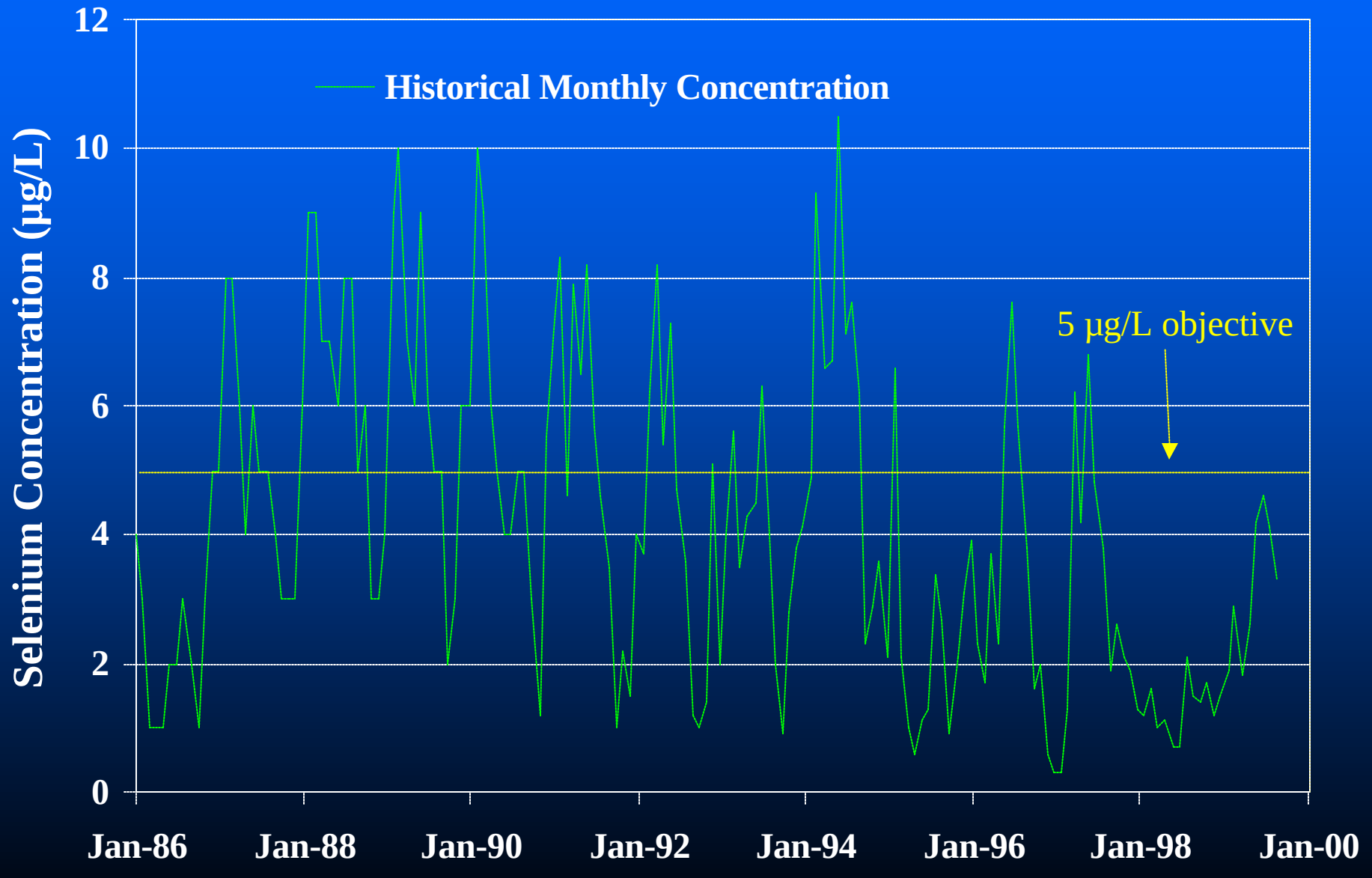

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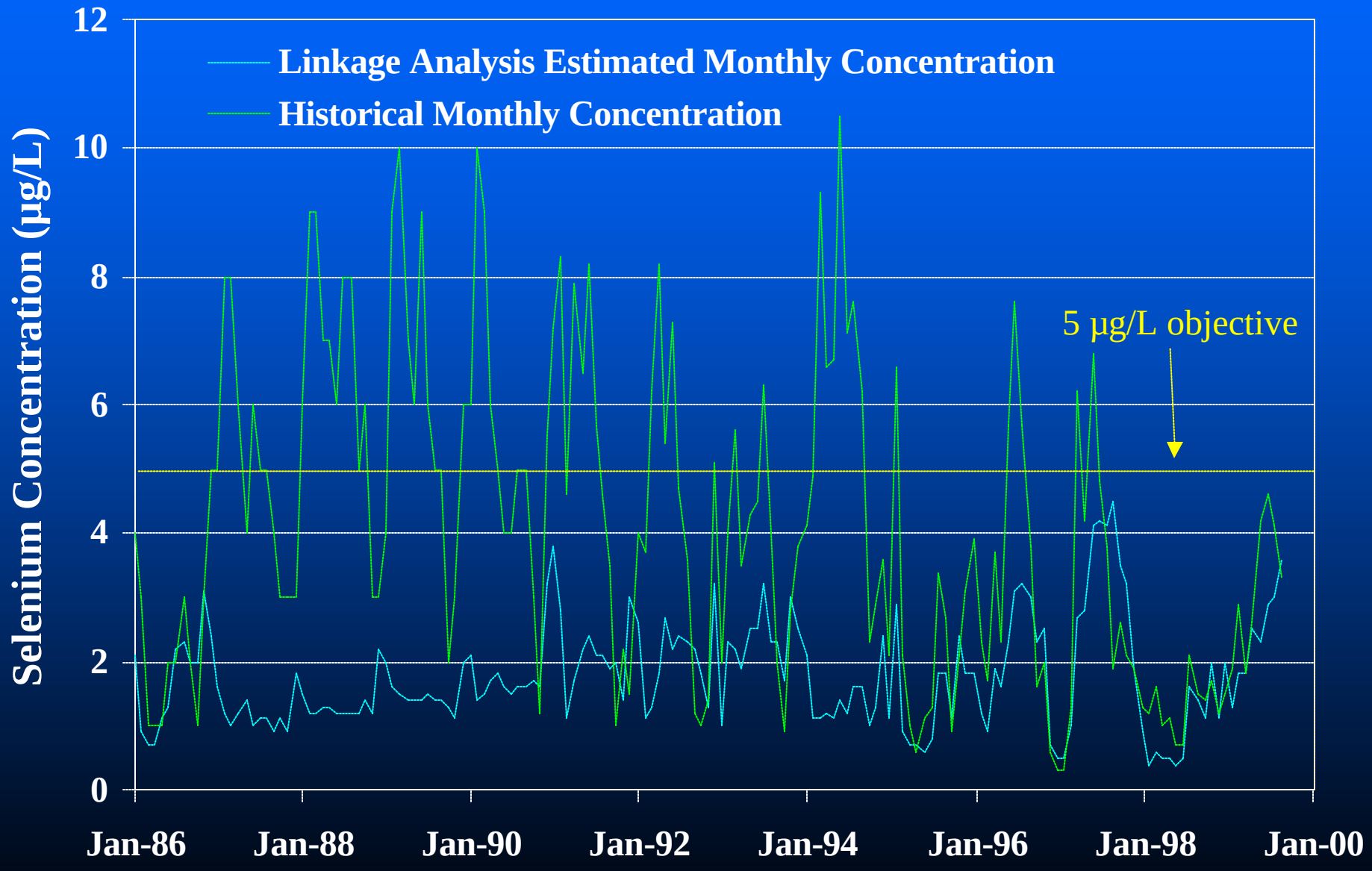

Linkage Analysis

- No violations of 5 µg/L mean monthly objective for 15 year period from 1986 through 1999
- Detailed look at 4-day average selenium…
- Six violations of 5 µg/L 4-day average objective for 15 year period from 1986 through 1999

Components of TMDL

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TMDL Report

Implementation Plan

TMDL Report

- Technical TMDL
  - Draft Technical TMDL Report completed May 2001
  - Final Technical TMDL Report to be submitted to USEPA June 2001

Components of TMDL

TMDL Description

Numeric Target

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Implementation Plan

TMDL Implementation

- 1996 Basin Plan Amendment established implementation framework for this TMDL
  - Selenium water quality objectives and performance goals
  - Prohibition of discharge to wetland channels
  - Grassland Bypass Project and use of San Luis Drain
  - Establishment of waste discharge requirements
  - Establishment of consensus based interim load limits
- TMDL load limits will be implemented through updated Waste Discharge Requirements

Selenium Performance Goals and Water Quality Objectives

Water Body (Year Type)	1 Oct 1996	1 Oct 2002	1 Oct 2005	1 Oct 2010
Wetland Channels listed in App 40 of Basin Plan	**2 µg/L monthly avg** →			
SJR below Merced River (W and AN)		*5 µg/L monthly avg*	**5 µg/L 4-day avg** →	
SJR below Merced River (D/BN and C)		*8 µg/L monthly avg*	*5 µg/L monthly avg*	**5 µg/L 4-day avg**
Mud Slough (north) and SJR from Sack Dam to Merced River				**5 µg/L 4-day avg**

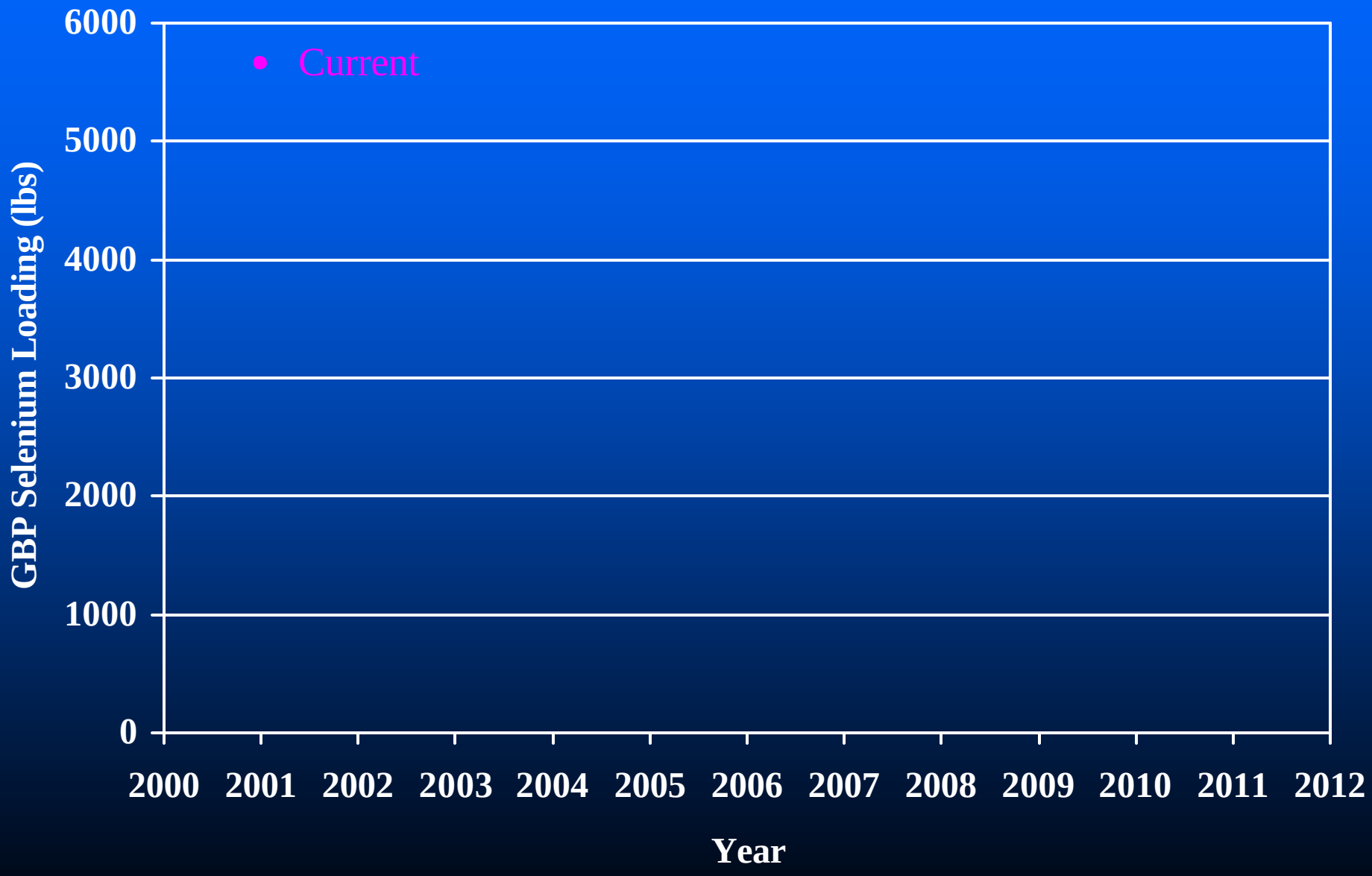
Performance Goals (in italics) and Water Quality Objectives (in bold)

Selenium Load Limits

SJR at Crow's Landing

2001 TMDL		2001 Draft WDR		
Year Type	2001 TMDL Load Allocation (lbs)	2003 WDR Load Limits (lbs)	2006 WDR Load Limits (lbs)	2011 WDR Load Limits (lbs)
C	1,073	4,995	3,915	1,073
D/BN	2,495	4,995	4,057	2,495
AN	4,163	4,995	4,163	4,163
W	4,479	4,995	4,479	4,479

Selenium Load Limits



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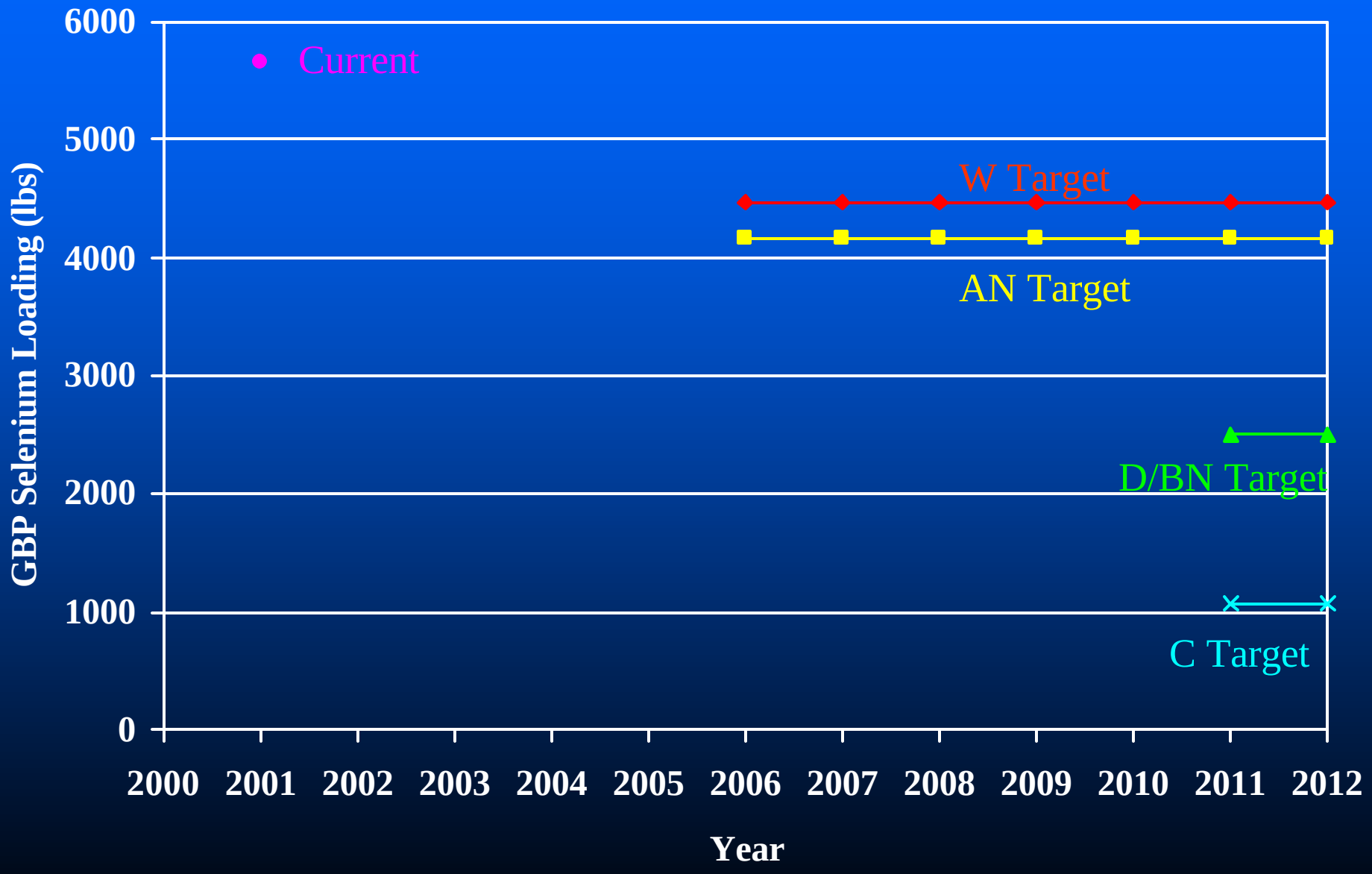

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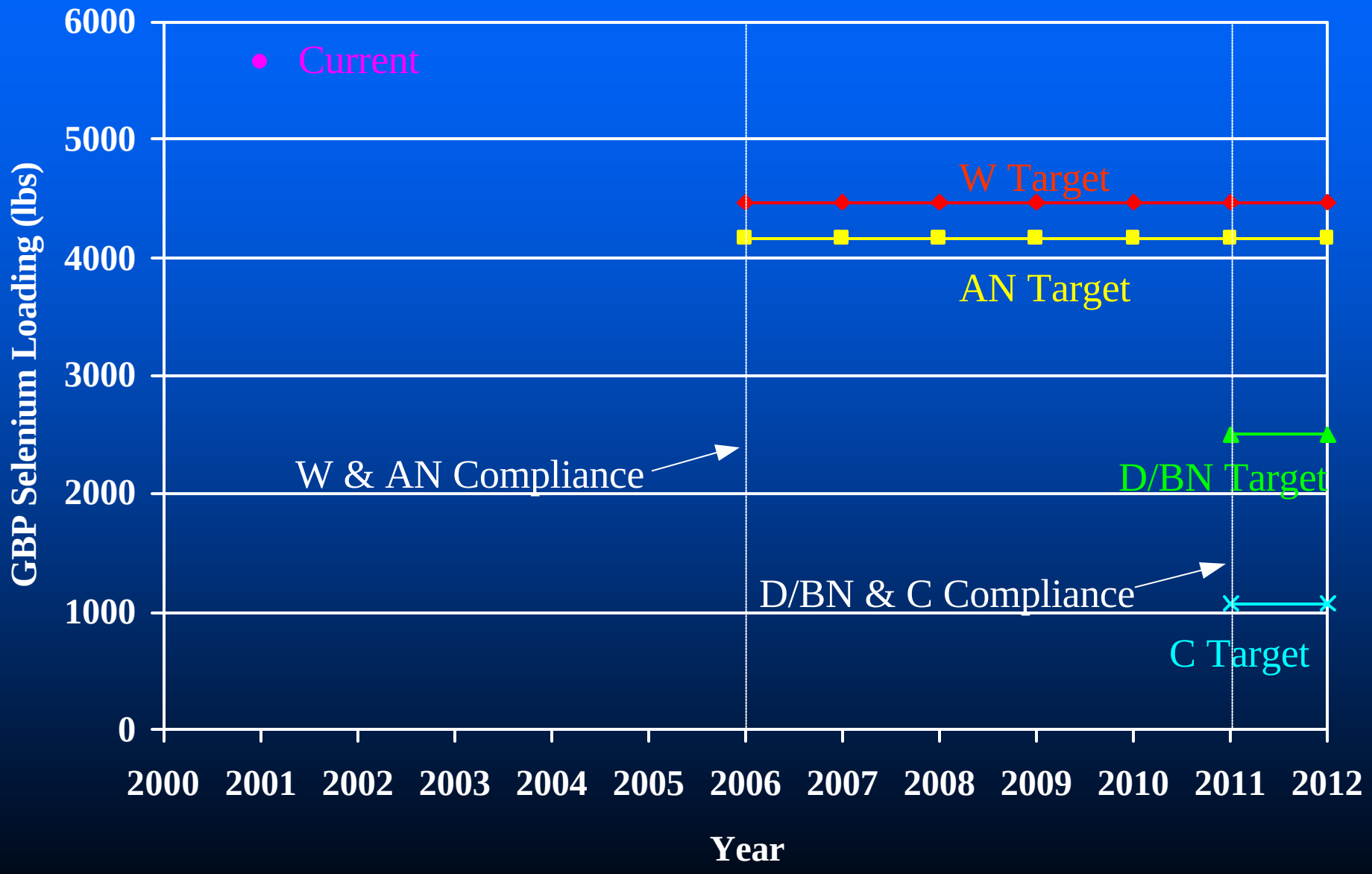

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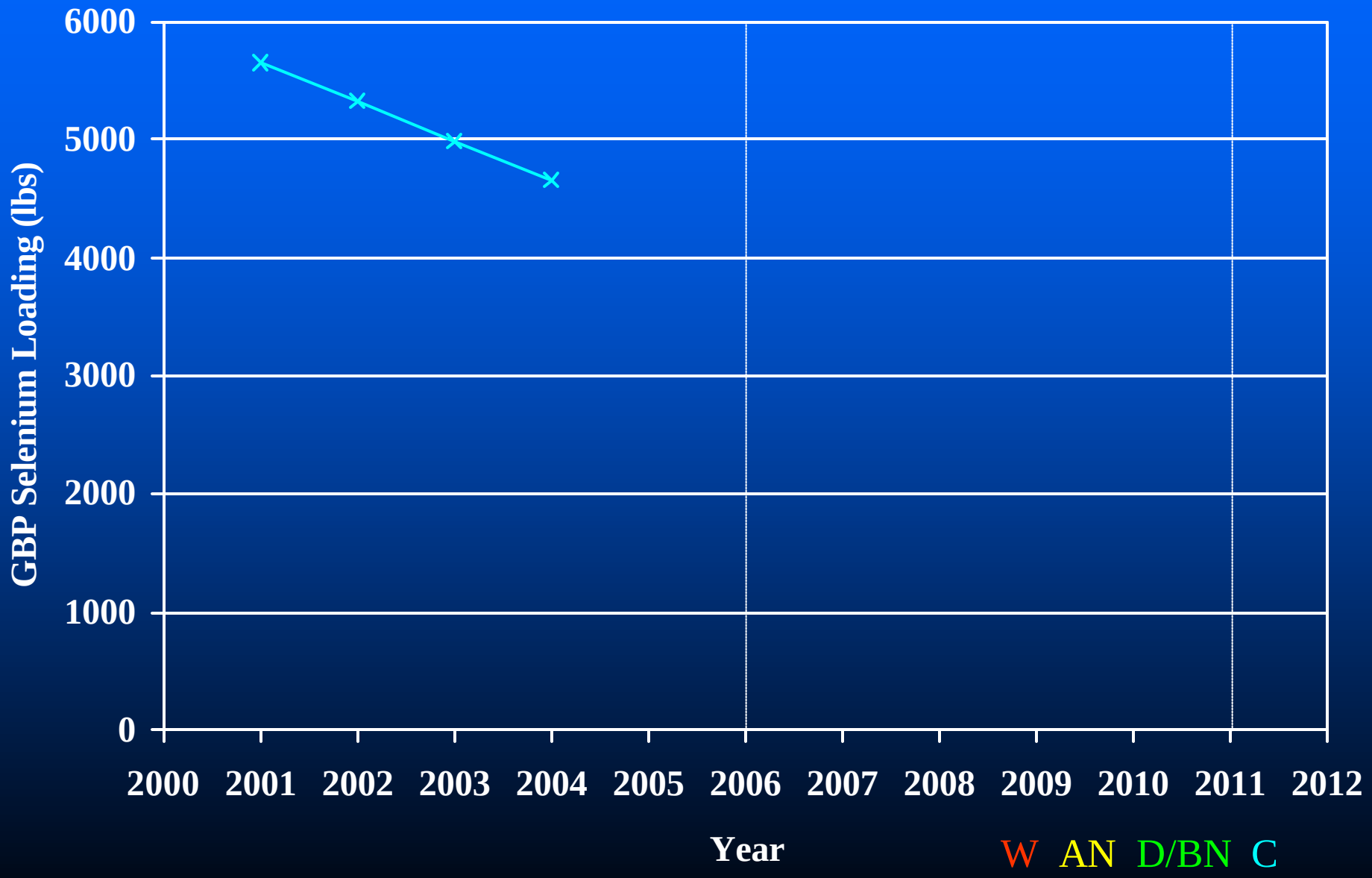

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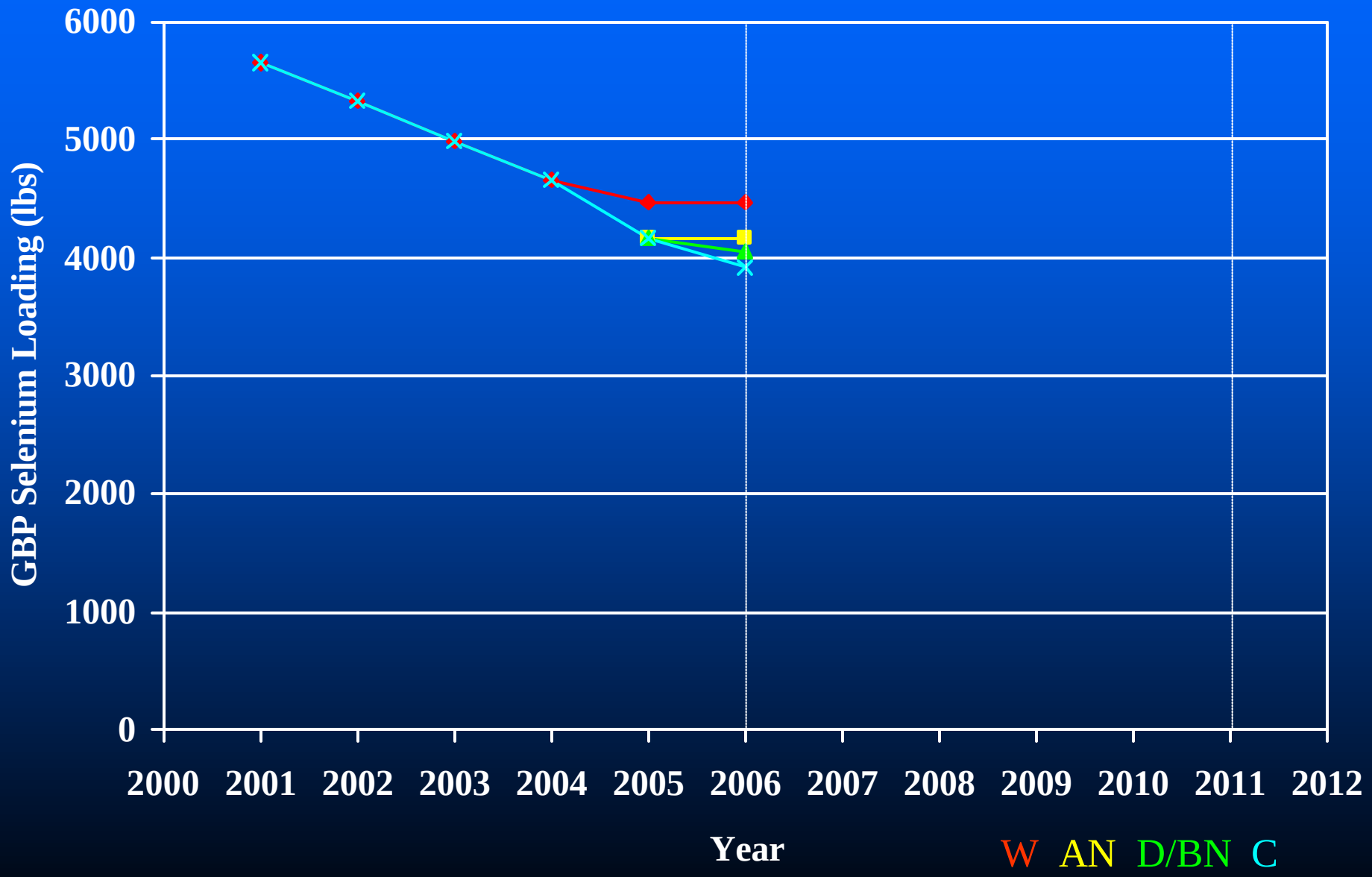

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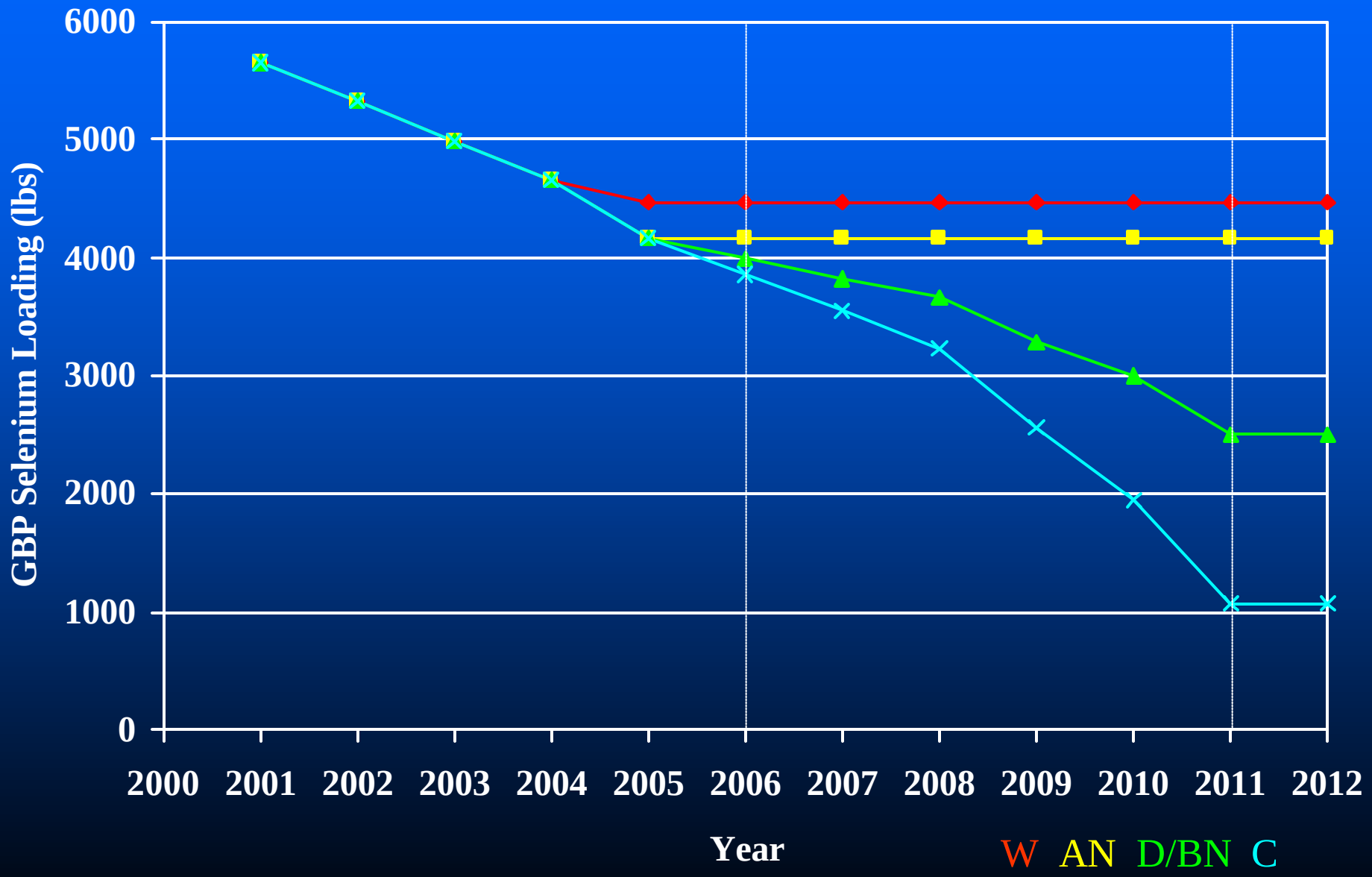

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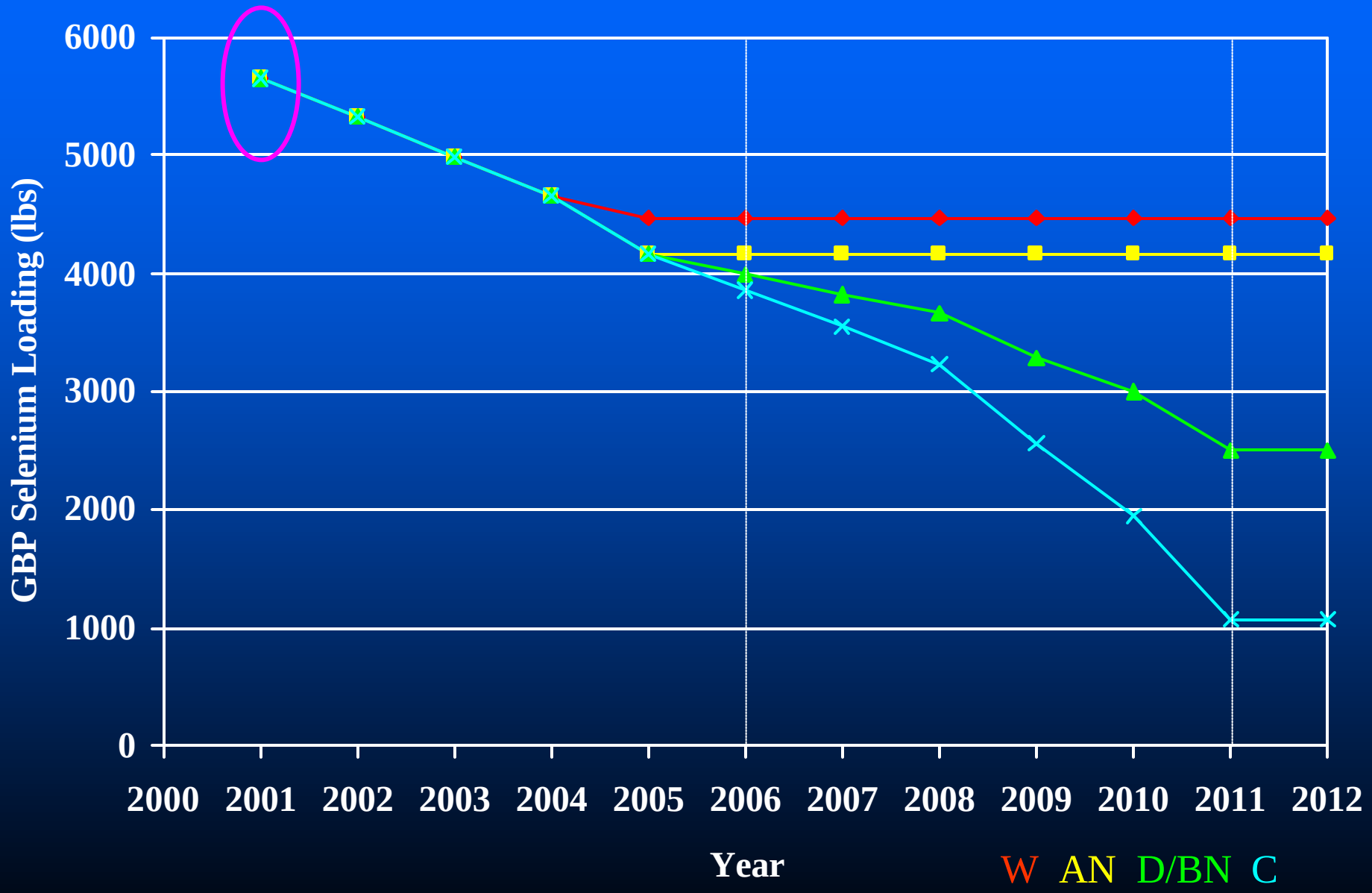


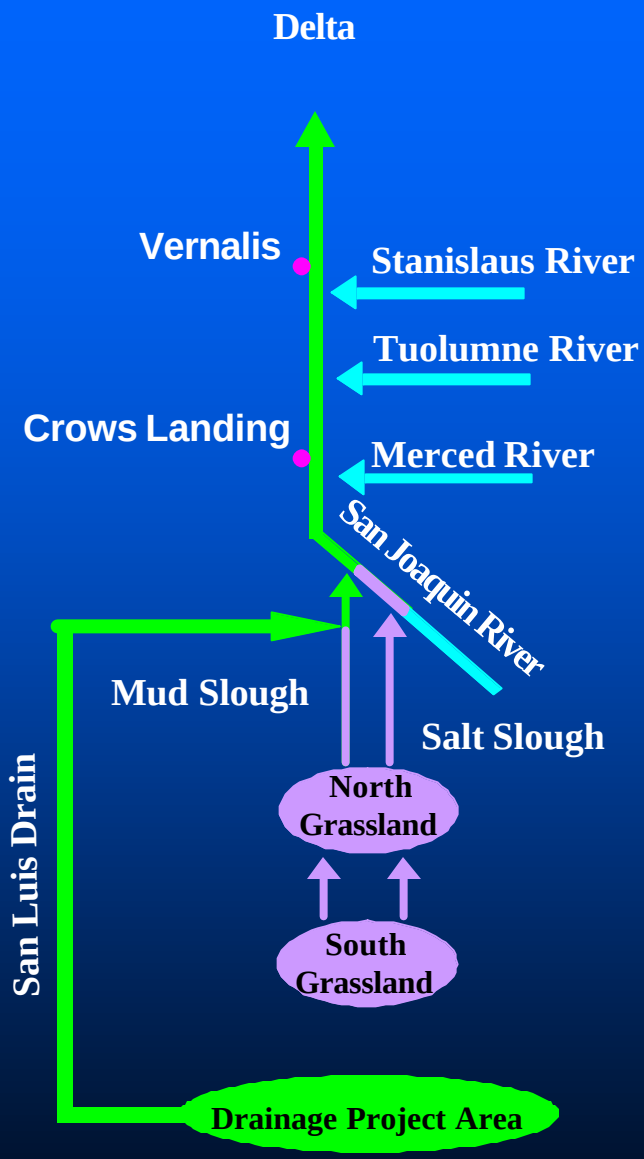
Lower San Joaquin River (2001)

All Years

Impaired
57 miles natural channels

Improved
31 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired



Selenium Load Limits

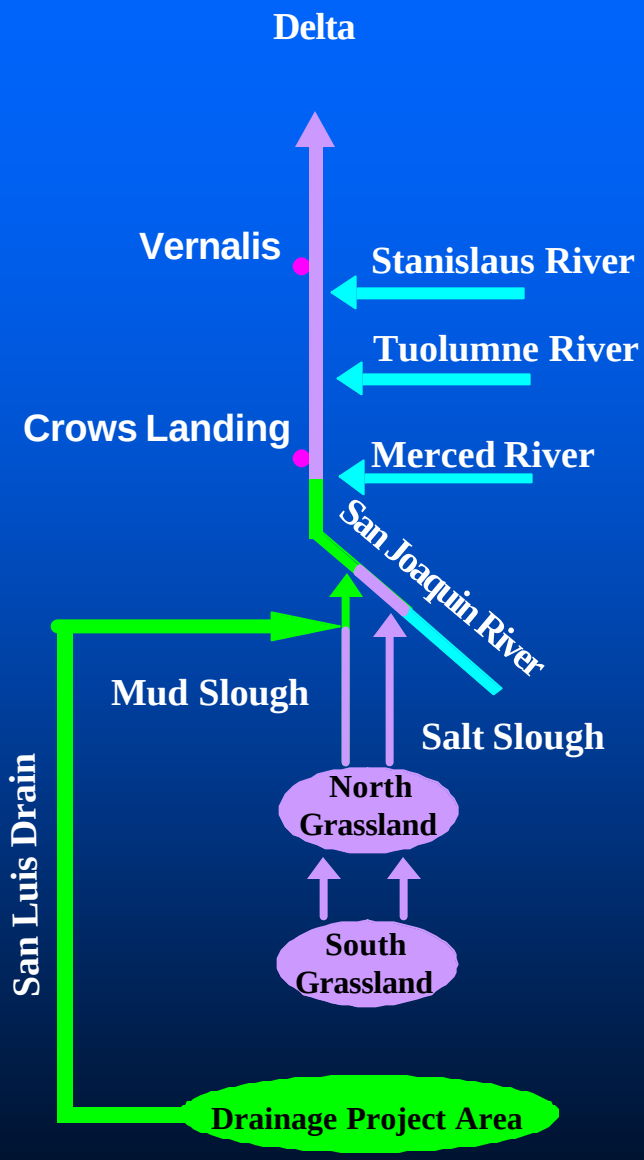
Lower San Joaquin River (2006)

Wet, Above Normal Years

Impaired
11 miles natural channels

Improved
77 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired



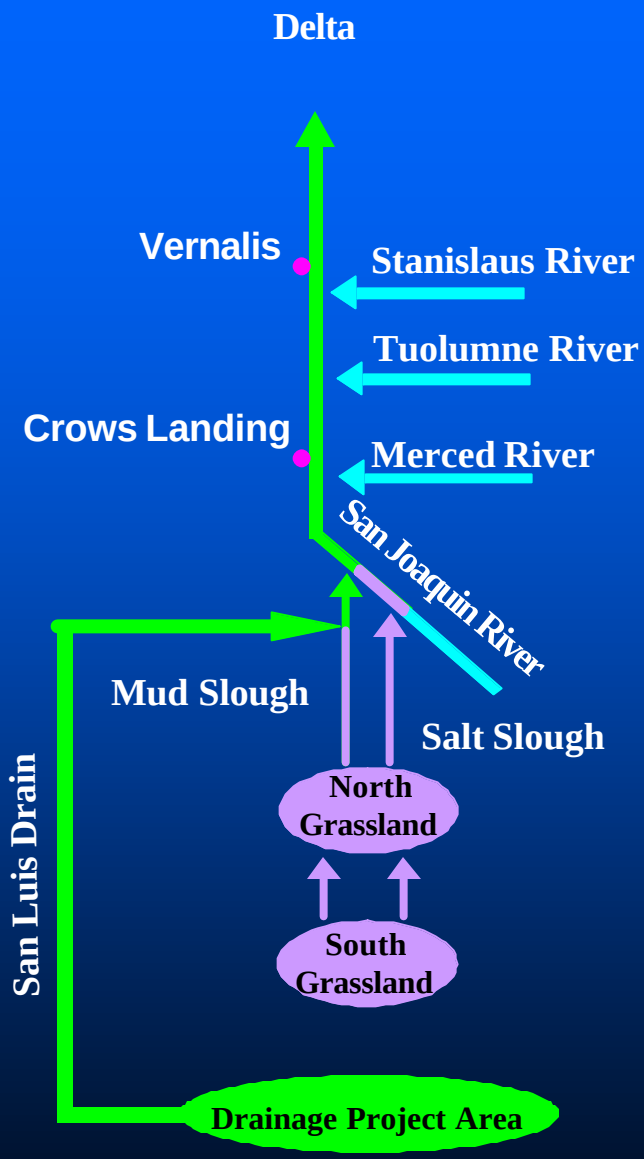
Lower San Joaquin River (2006)

Below Normal, Dry, Critical Years

Impaired
57 miles natural channels

Improved
31 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired



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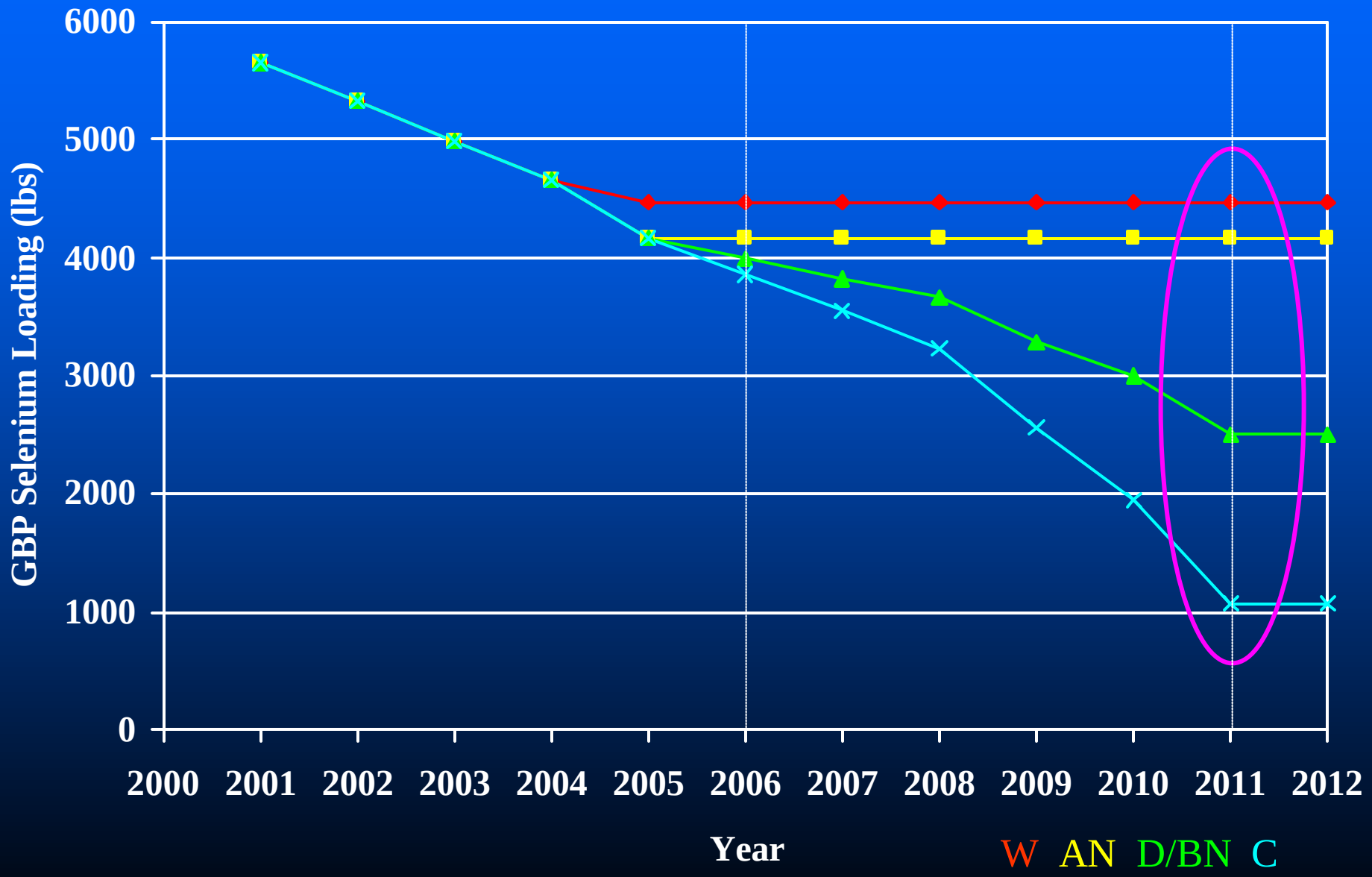


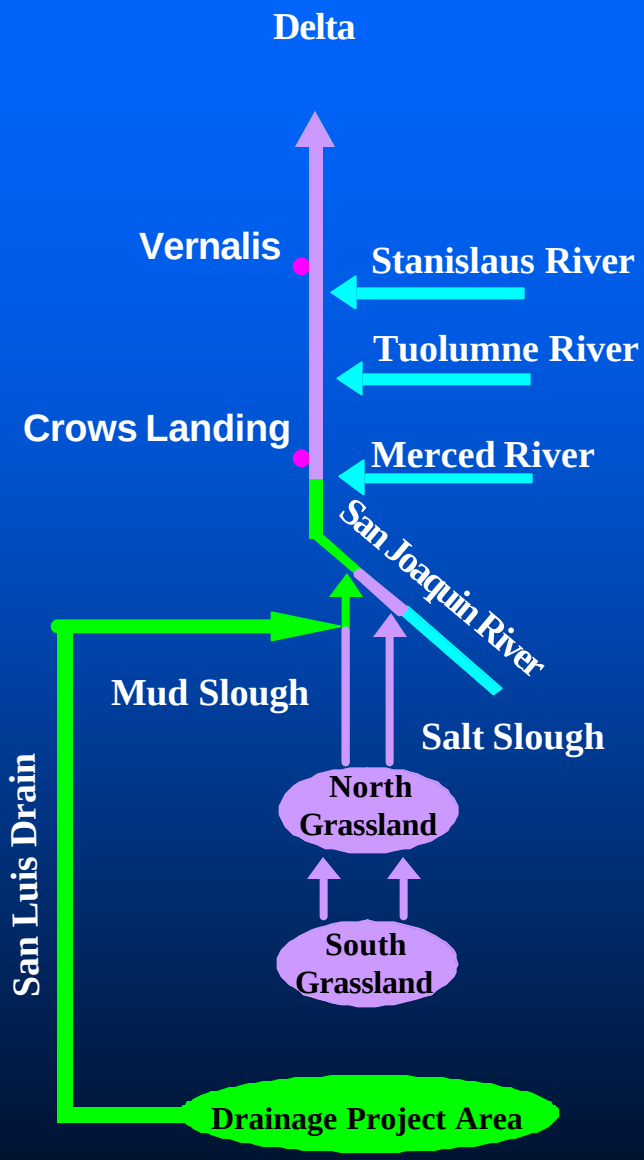
Lower San Joaquin River (2011)

All Years

Impaired
11 miles natural channels

Improved
77 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired



Selenium Performance Goals and Water Quality Objectives

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Mud Slough (north) and SJR from Sack Dam to Merced River				**5 µg/L 4-day avg**

Performance Goals (in italics) and Water Quality Objectives (in bold)

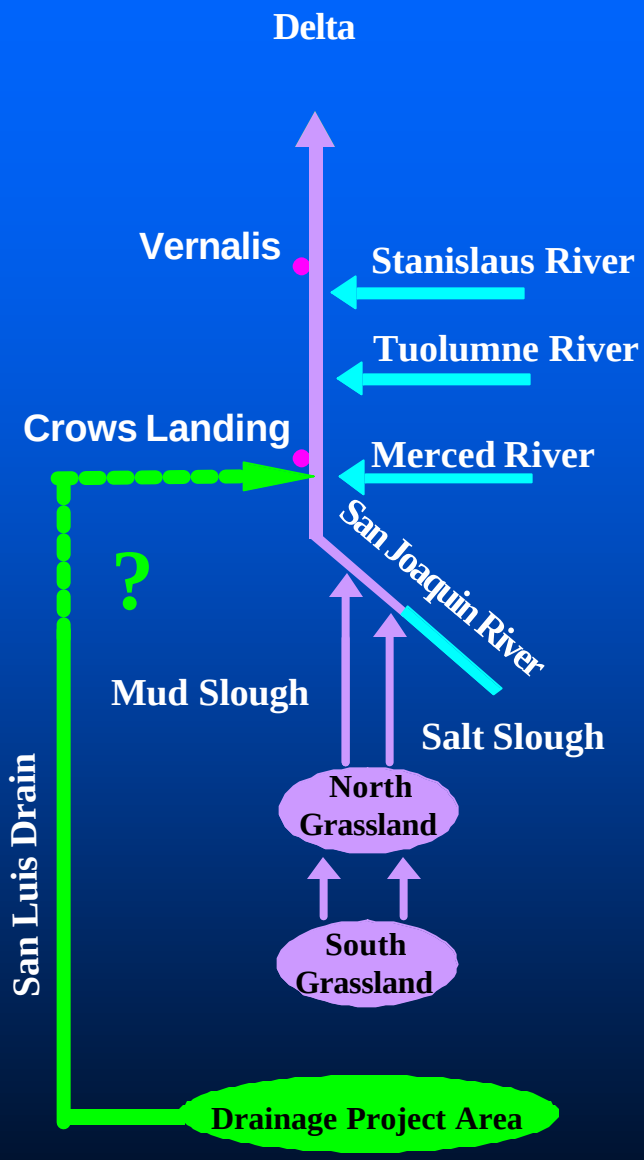
Lower San Joaquin River (2011)

All Years

Impaired
0 miles natural channels

Improved
88 miles natural channels
75 miles wetland channels
61,810 acres wetlands

Unimpaired



Staff Contacts

Staff	Topic	Phone	e-mail
Matt McCarthy	San Joaquin River Selenium TMDL Project Lead	(916) 255-0735	mccartm@rb5s.swrcb.ca.gov
Les Grober	San Joaquin River TMDL Unit Chief	(916) 255-3091	groberl@rb5s.swrcb.ca.gov